Name: _____

Class: _____

Due Date: _____

Physics Topic 11A – Applying Newton's Second Law of Motion

Answer the following questions. The solutions to this worksheet can be found on the YouTube channel Go Physics Go.

1. E: A 14.0 kg mass is at rest on a horizontal surface.

   a. Draw a free body diagram.

   b. What is the force of gravity acting on the object?

   c. What is the normal force acting on the object?

2. E: Ishmael pushes a 16.0 kg block to the left on a rough horizontal surface with a force of 70.0 N. The block does not move.

   a. Draw a free body diagram.

   b. What is the force of gravity acting on the object?

   c. What is the normal force acting on the object?

   d. What is the force of friction exerted on the block?

   e. What is the coefficient of static friction?

3. E: Isaac pushes a 18.0 kg block to the left on a smooth horizontal surface with a force of 70.0 N.

   a. Draw a free body diagram.

   b. What is the force of gravity acting on the object?

   c. What is the normal force acting on the object?

   d. What is the horizontal acceleration of the block?

   e. What is the vertical acceleration of the block?

4. E: Jacob pushes a 20.0 kg block to the left on a rough horizontal surface with a force of 70.0 N. The block moves at a constant speed of 2.00 m/s.

   a. Draw a free body diagram.

   b. What is the force of gravity acting on the object?

   c. What is the normal force acting on the object?

   d. What is the horizontal acceleration of the block?

   e. What is the vertical acceleration of the block?

   f. What is the force of friction exerted on the block?

   g. What is the coefficient of friction μ between the block and the surface?

5. E: Adam pushes a block with a mass of 24.0 kg to the right on a rough horizontal surface with a coefficient of kinetic friction of 0.300. The block moves with a constant acceleration of $2.00\ \frac{\mathrm{m}}{\mathrm{s}^2}$.

   a. Draw a free body diagram.

   b. What is the force of gravity acting on the object?

   c. What is the normal force acting on the object?

   d. What is the force of friction exerted on the block?

   e. What is the force of push given to the block?

6. E: Joseph is pulling a 65.0 kg block with a force of 800. N at an angle of 45.0° north of east above the horizontal of a rough horizontal surface. The coefficient of friction between the block and the surface is $\mu = 0.300$.

   a. Draw a free body diagram.

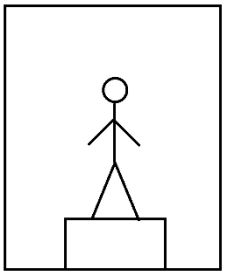
   b. What is the vertical acceleration of the block?

   c. What is the normal force acting on the block?

   d. What is the horizontal acceleration of the block?

7. E: An 80.0 kg man is standing on a scale in an elevator.

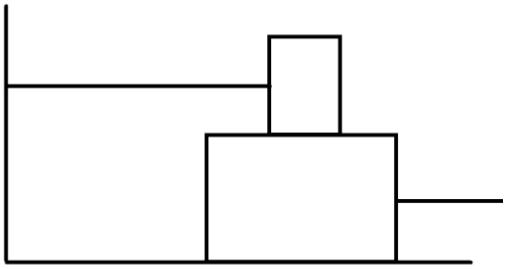
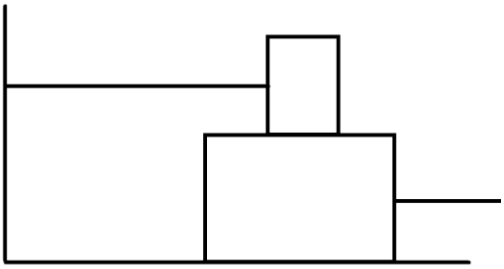
   a. Draw a free body diagram for the scale.



   b. Determine the reading on the scale when
      i. the elevator is at rest.
      ii. the elevator is moving up with a constant speed of $2.00\ \frac{\mathrm{m}}{\mathrm{s}}$.
      iii. the elevator is moving down with a constant speed of $2.00\ \frac{\mathrm{m}}{\mathrm{s}}$.
      iv. the elevator moves upwards with a constant acceleration of $2.00\ \frac{\mathrm{m}}{\mathrm{s}^2}$.
      v. the elevator moves downwards with a constant acceleration of $2.00\ \frac{\mathrm{m}}{\mathrm{s}^2}$.

8. E: A block with a mass $m_2 = 15.0$ kg is on a rough horizontal surface. There is a string pulling it to the right with a force F_P at a constant speed. Above m_2 there is a block with a mass $m_1 = 12.0$ kg. There is a string attached to the left of m_1 which is attached to a wall which has a force of tension F_T. The coefficient of friction between m_1 and m_2 is $\mu_{1,2} = 0.250$ and the coefficient of friction between m_2 and the surface is $\mu_{2,\text{surface}} = 0.350$.

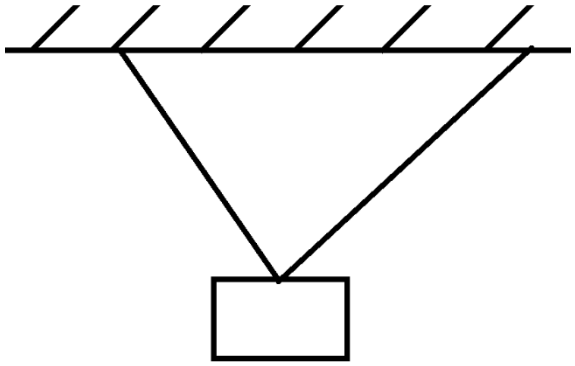
   a. Draw a free body diagram for each object.

For m_1	For m_2
	

   b. Determine the force of tension F_T and the pulling force F_P.

9. E: A 12.0 kg block is held in the air by two strings attached to the wall. The first string makes an angle of $\theta_1 = 60.0°$ north of west. The second string makes an angle of $\theta_2 = 45.0°$ north of east.

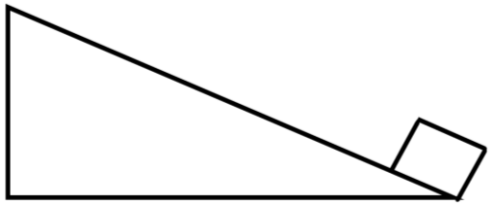
   a. Draw a free body diagram.



   b. Find the force of tension on each string.

10.E: A block with mass 15.0 kg is at rest on the bottom of an incline with $\theta = 25.0°$ which is 35.0 m long. The coefficient of friction between the block and the surface is $\mu = 0.450$. A man pushes the block up parallel to the incline with a force of 155 N.

a. Draw a free body diagram.



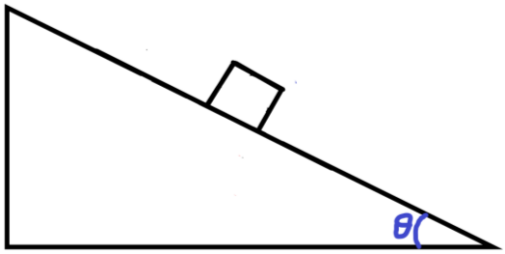
b. What is the acceleration of the block?

c. What will be the final speed of the block when it reaches the top of the incline?

d. How long will it take for the block to reach the top of the incline?

11.E: A block with mass 65.0 kg is initially at rest in the middle of an incline with $\theta = 25.0°$ which is 40.0 m long. The coefficient of friction between the block and the surface is $\mu = 0.450$. A man pushes the block down parallel to the incline with a force of 60.0 N. The block accelerates downwards at a constant rate. Let the acceleration from gravity be $\vec{g} = 9.81 \frac{\text{m}}{\text{s}^2}$.

a. Draw a free body diagram.



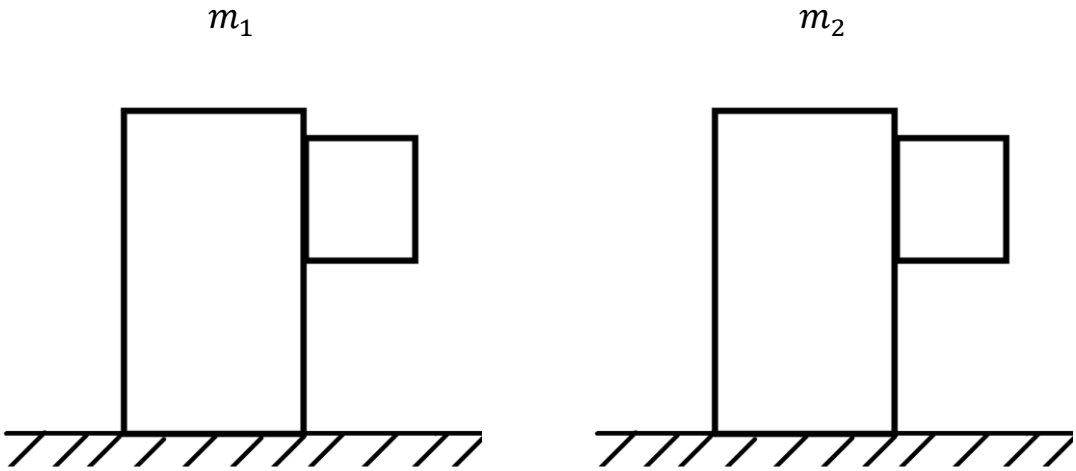
b. What is the magnitude of the acceleration of the block?

c. What will be the final speed of the block when it reaches the bottom of the incline?

d. How long will it take for the block to reach the bottom of the incline?

12.E: A block of mass m_1 is on a frictionless horizontal surface. There is another block of mass m_2 which is to the right of block m_1 and above the surface. m_1 is pushed and accelerated to the right so m_2 does not slide down.

a. **Use a pencil!** Label the forces on m_1 and m_2.



b. Determine an equation for the minimum pushing force in which m_2 does not slide down.

13.C: **Use a pencil and ruler!** Define *free fall*. Draw a *displacement vs. time* graph, a *distance vs. time* graph, a *velocity vs. time* graph, a *speed vs. time* graph, and an *acceleration vs. time* graph for an object dropped from rest in free fall.